Elliptic flow at high p_t in Au+Au collisions at $\sqrt{s_{NN}} = 130$ GeV

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In ultra-relativistic heavy-ion collisions hard processes happen early in the reaction processes and thus can be used to probe the early stage of the evolution of a dense system. During this early time a quark-gluon plasma (QGP) could exist. We report the first result on elliptic flow for charged particles with $p_t > 2$ GeV/c.

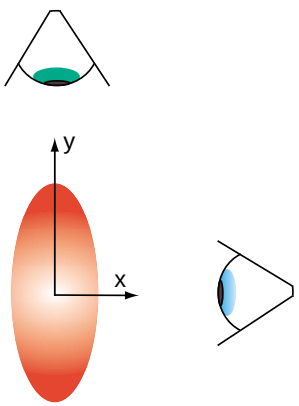

Figure 1: Schematic view of the initial spacial overlap region of a non-central collision. The $\hat{x}$ denotes the reaction-plane axis.

Medium induced radiative energy loss of high p_t partons (jet quenching) could be very different in a hadronic medium and a partonic medium. For non central collisions the hot and dense overlap region has an almond shape (see Fig. 1). This imposes different path lengths and therefore different energy loss for particles moving in the in-plane versus the out-plane direction.

Using the charged particles below $p_t = 2$ GeV/c to determine the reaction plane [1] we can study the azimuthal assymetry induced by this almond shape overlap region on the high-p_t particles. Fig. 2 shows the resulting $v_2(p_t)$ for charged particles upto $p_t = 4.5$ GeV/c. The filled circles are the STAR data, the error bars shown are only the statistical errors. The systematic errors are 10% upto 2 GeV/c and increasing to 20% at 4.5 GeV/c. The lines shown are; a hydrodynamical model calculation [2] and pQCD calculations [3] matched to hydro at low p_t. The hydro calculation matches the data well upto 1.5 GeV/c, but after that there is clear deviation. However, at $p_t = 4.5$ GeV/c the v_2 parameter is still around 15% which indicates that the particles at high-p_t still suffer a significant amount of interactions. Within the pQCD calculations this would constrain the initial gluon density (dN^g/dy) for Au+Au collisions at $\sqrt{s_{NN}} =$ 130 GeV between 500 and 1000.

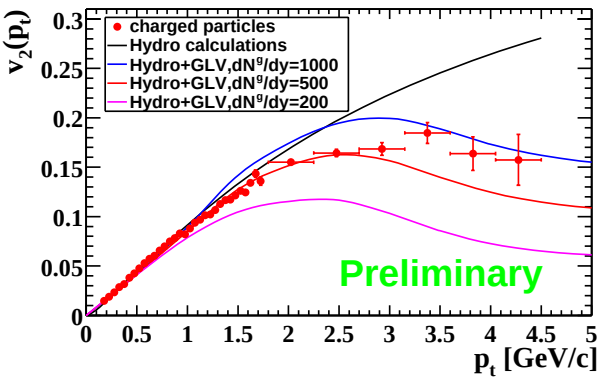

Figure 2: The measured elliptic flow for charged particles as a function of p_t. The lines are a hydrodynamical [2] and pQCD calculations [3].

References

[1] STAR Collaboration, K.H. Ackermann *et al.*, Phys. Rev. Lett. **86**, 402 (2001).

[2] P. Huovinen *et al.*, nucl-ph/0101136.

[3] M. Gyulassy, I. Vitev and X.N. Wang, nucl-th/0012092.